There can be no doubt that the Mont Mounier observatory, started under such favourable conditions, and so well supplied with instruments, will considerably assist in the advance of science.

DR. ADALBERT KRÜGER.

ASTRONOMERS in all observatories and of all nationalities will have learned with regret of the death of Dr. Krüger, the Director of the Kiel Observatory, but who, perhaps, will be more generally recalled as the editor of the *Astronomische Nachrichten*, and gratefully remembered for his services to that journal. From the time that Schumacher, under the auspices of the Danish Government, started the *Nachrichten*, no astronomical journal has proved itself so indispensable, both as a means for the publication of observations and the dissemination of astronomical knowledge, or contributed more to its advance and progress. For that large class of observations of which early publication is its greatest value, but the details of which are a weariness to most editors, the *Astr. Nach.* has stood unrivalled, and its general conduct has wisely preserved the broad lines on which it was originally established. And with the progress of time, as the eagerness of observers has increased with their numbers, Prof. Krüger has recognised the necessity of still more rapid means of communication, and by adding to his manifold duties that of the management of the *Bureau central des dépêches astronomiques*, he has made still further demands on our gratitude, for the ease and certainty with which astronomical discoveries are sent all over the globe, and made available to those who take advantage of the system he has elaborated. Prof. Förster, of Berlin, we believe, early advocated the plan which has proved itself so useful, but the details of the management have been wisely left in the hands of the Director of the Kiel Observatory.

But these services to science, rendered continuously from 1880, when the death of Dr. Peters made vacant both the positions which Dr. Krüger has since filled so admirably, should not put out of sight the fact that he has been both a skilled observer and an ardent astronomer. It is sufficient to recall here his more prominent services, such as the share he took with the late Dr. Schönfeld in the observation of the zones for the *Durchmusterung* at the Bonn Observatory: a work at first voluntarily undertaken on his part, but later in regular and active co-operation with Argelander and Schönfeld. Here, too, during an absence of Dr. Winnecke, which prevented the heliometer being used, he began and carried to a successful issue the determination of the parallax of 70 Ophiuchi, in two very accordant series.

In 1862 Dr. Krüger was appointed Director of the Helsingfors Observatory, in which the instrumental equipment was probably insufficient. There he busied himself with an inquiry into the orbit of Themis, with the view of obtaining a more accurate value of the mass of Jupiter, which the continued observation of that planet is likely to afford. The result, published in the *Proceedings* of the Finnish Society of Sciences, was to show that Bessel's value of the mass of Jupiter, the then received value, required to be increased by the 68/100,000 part, and to give a value intermediate between that of Airy and Bessel, as derived from the motions of the satellites.

From Helsingfors, Dr. Krüger went to the Observatory at Gotha, where he stayed five years, leaving that city to take up his final position at the well-equipped Kiel Observatory, in 1880. For after the termination of the Danish dominion in the Elbe Duchies, the observatory had been enriched by the instruments from the old observatory at Altona, and had been brought into closer relations with the university. This position naturally carried with it the editorship of the *Nachrichten*, to which allusion has already been made. It is true that since the journal has been under his care, the words "Unter Mitwirkung des Vorstandes der Astronomischen Gesellschaft" have appeared on the title-page, but we imagine Dr. Krüger has enjoyed a free hand in its management, with beneficial results to the journal and to his own reputation. In his capacity as Director, he has published many observations of comets, and prepared, or had prepared under his own eye, the orbits and ephemerides of many of these bodies. These computations have been occasionally enriched by notices of a mathematical character, such as the effect of perturbations by planets near the sun. He has also occasionally given original observations of stars observed with comets, and in many useful, if not brilliant, ways, he has shown his capacity as a Director of an observatory. His career has been marked by an energy and industry, to which might be applied the words of Schiller, "Beschäftigung die nie ermattet, die langsam wirkt doch nie zerstört."

NOTES.

THE first of the two annual conversaziones of the Royal Society was held last night, as we went to press.

THE Council of the British Association have resolved to nominate Sir John Evans, K.C.B., Treasurer of the Royal Society, for the presidency at the meeting which will be held next year in Toronto.

THE following fifteen candidates were selected on Thursday last by the Council of the Royal Society, to be recommended for election into the Society:—Sir G. S. Clarke, Dr. J. N. Collie, Dr. A. M. W. Downing, Dr. F. Elgar, Prof. A. Gray, Dr. G. J. Hinde, Prof. H. A. Miers, Dr. F. W. Mott, Dr. J. Murray, Prof. K. Pearson, Rev. T. R. R. Stebbing, Prof. C. Stewart, Mr. W. E. Wilson, Mr. H. B. Woodward, Dr. W. P. Wynne. The qualifications of the candidates will be found in another part of this issue.

THE Surinam Toads (*Pipa americana*), at the Zoological Society's Gardens, have recommenced breeding this year, and two of the females may now be seen with their backs covered with cells, in each of which an egg is located. The hitherto unexplained mode in which the eggs are transferred into their cells has been discovered, and the secret was divulged at the last scientific meeting of the Society.

AN unnamed donor has given Harvard University 100,000 dols. to found a Chair of Comparative Pathology, the only one of the kind in any leading American University.

THE generous hospitality always dispensed to British men of science by continental Governments beggars anything ever done officially in England to welcome foreign visitors distinguished in science. We have already notified that the summer meetings of the Institution of Naval Architects will be held this year in Hamburg on Monday, June 8, and the following day. On Wednesday, June 10, the meetings will be transferred to Berlin, on the invitation of the Imperial German Government, and will be continued there during the remainder of the week. With a public spirit which should put British steamboat companies to shame, the Hamburg-American Company have generously offered to take the members over in a body from Tilbury to Hamburg in their twin-screw Transatlantic liner the *Fürst Bismarck* free of charge. The steamer will start either late on Saturday night, June 6, or else early on Sunday morning, June 7, and will arrive in Hamburg in about twenty hours after its departure. The meetings are receiving the warmest support from the Imperial Government, and the arrangements in Berlin are being carried out by the Imperial

Ministry of the Interior and the Imperial Ministry of Marine. A programme of exceptional interest for the instruction and entertainment of the members is already in course of preparation. The meetings for the reading and discussion of papers will be held in Hamburg in the Bürgerschafts-Saal in the building of the Patriotische Gesellschaft, and in Berlin in the large hall of the Technical High School. Papers have already been promised by the following German members of the Institution:—Herr Dietrich (Privy Councillor), Constructor-in-Chief of the Imperial German Navy, Herr F. Laeisz, President of the Chamber of Commerce of Hamburg, and by Mr. B. Martell and Dr. F. Elgar, amongst other home members of the Institution. It is hoped that the members of the Institution will do all in their power to assist in doing honour to their most hospitable hosts by attending in large numbers.

It is with sad feelings that we read of the elaborate preparations that have been made abroad to celebrate the centenary of the discovery of vaccination, and reflect that nothing is being done in England to honour Jenner's memory. The *British Medical Journal* says:—On May 14, 1796, Edward Jenner performed the first successful vaccination. The centenary of that event is to be celebrated in a manner befitting its importance in the history of mankind in Germany, Russia, and the United States. In Berlin preparations have been made under the direction of a Committee which includes Profs. Virchow, Gerhard, von Leyden, Robert Koch, von Bergmann, Koenig, Heubner, Langerhans, Proskauer, and other leading representatives of medical and sanitary science, for a great meeting on May 14 in honour of the discoverer of vaccination. There is also to be an exhibition in the Medicinische Waarenhaus (Friedrichstrasse, 108 I, Berlin, N.) of literature, old and new, relating to vaccination, portraits, medals, instruments, &c. In St. Petersburg, the Russian Public Health Society, the Honorary President of which is the Grand Duke Paul Alexandrovitch, has, with the sanction of the Czar, organised a commemoration festival on a still larger scale. On May 14 a "general and solemn" meeting will be held in honour of the discovery. Four prizes will be awarded for the best works on vaccination. An exhibition of objects connected with vaccination will be held. A Russian translation of Jenner's writings, with a biography and portrait, and reproductions of his drawings, will be published under the editorship of Dr. W. O. Hubert. The Council of the Society, with the help of the Government, of provincial and municipal administrative bodies, of scientific societies, and private medical practitioners, has collected materials for a history of small-pox and vaccination in Russia, which will appear at the same time. In the United States arrangements for the celebration of the centenary have been made by a conjoint Committee appointed by the American Medical Association and the American Public Health Association. The celebration is fixed for May 7, the third day of the meeting of the American Medical Association at Atlanta, and the whole of that day will be occupied by addresses and discussions on Jenner and vaccination. Truly is a prophet without honour in his own country when that country is England.

Sir John Gorst stated in the House of Commons, on Thursday last, that arrangements are being made to open the Geological Museum in Jermyn Street on Sundays, but the continuance of the practice will depend upon how far the number of visitors appears to justify it.

The *Botanical Gazette* has passed into the possession of the University of Chicago. It is not, however, to be the botanical organ of the University, but will be freely open, as before, to botanists of all parts of the globe. The object of the change is to secure permanence and possibility of development. The old editors, Prof. J. M. Coulter, Prof. C. R. Barnes, and Prof. J. C. Arthur, remain.

We learn from the *Botanical Gazette* that the recent "Culver gift" of one million dollars to the University of Chicago for biological endowment has resulted in the establishment of a Department of Botany, in which Dr. John M. Coulter has accepted the head professorship. A large building, to be known as the "Hull Botanical Laboratory" has been planned, and its erection will soon be begun. The four stories of this building will contain ample space for lecture-rooms, libraries, laboratories, and private research rooms for morphology, physiology, and taxonomy. Above the fourth story a large roof-greenhouse will supply an abundance of living material under all conditions. As the building will not be completed before April 1897, the full botanical staff will not be organised before the autumn of that year.

During the last few weeks some experiments in sea-fish hatching have been carried on at the Port Erin Biological Station, for the Lancashire Sea Fisheries Committee. Prof. Herdman has erected a series of wooden tanks and sand filters, through which the water is passed by the action of a water-wheel worked by the fresh-water tap. The Sea Fisheries steamer, *John Fell*, spent several days at Port Erin trawling for the spawning fish. The ova were fertilised on board, and then conveyed to the tanks. The first batch of young fish ("witches" or white soles) were hatched out on April 29, exactly seven days after fertilisation; and there are now in the tanks, far advanced in their development, lemon soles, witches, and grey gurnards. The work, so far, has been carried out successfully, and the result ought to encourage the Lancashire Committee to realise their project of erecting a sea-fish hatchery near the principal spawning grounds of the Irish Sea.

We regret to note the death of the Rev. W. C. Ley, on the 22nd ultimo, at the age of fifty-five. He was ordained in 1863, and in 1874 was presented by the Lord Chancellor to the rectory of Ashby Parva, near Lutterworth, which he held until 1892. Mr. Ley had for many years paid special attention to the study of the clouds and the movements of upper air-currents. In 1872 he published an important work on "The laws of the winds prevailing in Western Europe," in which he showed how the preparation of synchronous weather charts, and the accumulating testimony of the universality of the law generally known as Buys Ballot's, connecting wind conditions with the distribution of barometric pressure, had proved some accepted weather theories to be erroneous, and had rendered necessary a new investigation of the general laws. In the year 1879 the Meteorological Council appointed him Inspector of their English stations, and in the following year they requested him to prepare a manual to facilitate the study of the weather in connection with the information supplied by their Daily Weathe Reports. This work, entitled "Aids to the study and forecast of weather," explains clearly the relations of weather conditions to the distribution of areas of both high and low atmospheric pressure. His most recent work, "Cloudland, a study on the structure and characters of clouds," published in 1894, was prepared for press by his son, owing to the serious illness of the author. It embodies the results of his life's work in connection with this subject; the nomenclature is probably too advanced for general adoption, but the treatise contains much valuable information upon the classification of the clouds and the origin of their formation, as well as upon the important bearing of cloud observation on the prognostication of weather. Many papers of minor importance were contributed by Mr. Ley to the *Journal* of the Royal Meteorological Society.

Mr. F. E. Beddard, F.R.S., gave the first of a course of lectures on the animals in the Zoological Society's Gardens, in the lecture-room at the Gardens, on Saturday last. The lecture was of an introductory character, explaining the position of Mammals amongst the Vertebrates, and their classification into three main divisions. The extinct Multituberculata and their possible relation to the Monotremes were also spoken of. The course will be continued every Saturday at 4 p.m. until July 4.

AT the International Meteorological Conference at Munich, in 1891, a Committee was appointed to consider the question of concerted observations on the direction of motion and the height of clouds. The report of this Committee was made to the International Meteorological Committee at their meeting at Upsala in 1894, the result being that all countries were invited to take part in the investigation of the upper currents of the atmosphere, by means of cloud observations, which are to commence on the 1st prox., and be continued for a year at least. For the use of observers who adopt the international classification recommended at Munich, a standard cloud atlas has been prepared, consisting of about thirty coloured pictures, and is now in course of publication in Paris; while persons who do not adopt that classification are at liberty to use the nomenclature employed in their country. The observations of motion may be made without instruments, or with simple nephoscopes; but the measurements of altitudes require the use of theodolites or photogrammeters, and can only be carried out at regular observatories. Descriptions of the methods to be employed have been published by Dr. Hildebrandsson, of Upsala, and others, and also in *Das Wetter* for February last. Various countries in Europe, the United States, and Java, have undertaken to make the more difficult instrumental observations, and it is recommended by the International Meteorological Committee that the observations from each country should be eventually published *in extenso*, as a separate publication.

THE south-east of Europe is one of the most pronounced seismic districts of the world, and it is gratifying to learn that the earthquakes there are to receive the attention they deserve. In a previous note, we have referred to the work of the seismological section of the meteorological observatory at Constantinople, and we have now to announce the formation of a similar section of that at Athens. This has been placed under the charge of Dr. S. A. Papavasiliou, who is well known for his careful investigation of the Locris earthquakes of 1894. Information with reference to Greek earthquakes has indeed been transmitted to the observatory since 1893, and the accounts of these shocks will be published later on. It is only, however, within the last few months that an attempt has been made to organise regular observations. At the observatory of Athens two Brassart seismoscopes of a simple character have been erected, one of them giving the time of occurrence of each shock felt there. The officials at the meteorological stations and telegraph offices (twenty-three in number) have been instructed to make observations, and forward their registers to the observatory; and, commencing with this year, a monthly seismological bulletin has been started. The number for January has just been published, and tends to confirm Dr. Papavasiliou's estimate that hardly a day passes without an earthquake being felt somewhere in Greece, for no less than thirty-four are recorded as occurring during January alone. The most interesting is an after-shock, on the 24th ult., of the great earthquakes of April 20 and 27, 1894, showing a still further displacement of the epicentre towards the W.N.W. along the great fault formed at the time of the last-mentioned shock.

IN Tunbridge Wells, on Saturday last, a congress was held of the naturalists of the South-Eastern District, with the object of forming a Union of Natural History Societies for mutual help and investigation. The idea originated with Dr. George Abbott, who carried out all the preliminary details for the congress. The first part of the day was taken up by the delegates inspecting the geological features of the town, and after luncheon they assembled in the Pump Room, where the congress was held, under the chairmanship of the Rev. T. R. R. Stebbing, President of the Tunbridge Wells Natural History and Philosophical Society, and whose name is amongst those selected for election into the Royal Society. A large number of delegates from important Natural History Societies of the south-eastern counties of England were present. Dr. Abbott described how the Union could be of assistance to science. Each Society in the Union would offer its members (1) free admission to their lectures and excursions; (2) copies of their Transactions; (3) the use of their library; (4) assistance in naming of specimens, and with the formation of school museums. The corresponding members, in return, would be asked to (1) forward surplus natural history specimens to their Societies' Museum; (2) supply prompt information on the following subjects: (*a*) new geological sections; (*b*) details of wells, borings, springs, &c.; (*c*) finds of geological and antiquarian interest; (3) answer such questions as the British Association or the local Society may require; (4) keep an eye on historic buildings; (5) assist the Selborne Society in carrying out its objects. Such appointments would be certain to stimulate individual investigation in the parishes, and useful scientific work would be done. After a discussion, the following resolution was adopted: "That the delegates from various scientific Societies of Surrey, Kent, and Sussex, assembled in congress at Tunbridge Wells on April 25, 1896, agree that the congress shall meet annually, by invitation, at the home of one or other of the associated Societies." The Rev. T. R. R. Stebbing was elected President of the Union, and Dr. Abbott, Secretary. It was agreed that Surrey, Kent, Sussex, Middlesex, and Hampshire should be included within the scope of the Union's operations.

AN extremely interesting series of experiments on the action of a powerful magnetic field on the kathodic rays in Crookes' or Hittorf's tubes, is described by Herr Kr. Birkeland in the *Elektroteknisk Tidsskrift* (Christiania). These experiments prove that in such a field, the kathode rays are strongly deflected in the direction of the lines of force, and can even be concentrated on to the surface of the tube until the glass melts. Moreover, the evidence suggests that the rays which emanate from one and the same kathode fall into groups, of which the physical constants are connected by some definite law, just as are the frequencies of the different tones emitted by a vibrating rod. The investigation has an important bearing on the theory of the Aurora Borealis. The Danish meteorologist, Herr A. Paulsen, is of opinion that the aurora owes its origin to phosphorescence of the air produced by kathodic rays in the upper strata of the atmosphere, and Herr Birkeland suggests that the earth's magnetism may be the cause of this phosphorescence becoming intensified in the neighbourhood of the terrestrial poles.

UNDER the editorship of Mr. F. S. Macaulay, of St. Paul's School, the first number of a new series of *The Mathematical Gazette* has just been issued by the Association for the Improvement of Geometrical Teaching. The size of the pages has been changed from quarto to demy octavo; by this change the *Gazette* has been brought into uniformity with the leading English and continental mathematical and other scientific octavo publications. The present number contains articles on "The Geometrical Method," by Dr. J. Larmor, F.R.S.; "Annuities treated without Progressions," by Dr. G. H. Bryan, F.R.S.; and "The Conic determined by Five Given Points," by the editor; together with a large number of problems and solutions. The *Gazette* deals exclusively with points of interest in the history and teaching of elementary mathematics (not extending beyond the Calculus), and it thus covers a somewhat different range of subject-matter to any other mathematical journal in the United Kingdom.

Messrs. Dulau and Co. have just issued a catalogue (No. xv.) of works on geographical botany, containing more than four thousand titles, offered for sale by them.

The Appendix of "Quain's Elements of Anatomy" (Longmans, Green, and Co.), which completes the tenth edition of the work, has now been published. The subject, "Superficial and Surgical Anatomy," is treated by Profs. G. D. Thane and R. J. Godlee.

We learn from the current (and final) number of the *American Meteorological Journal*, that the New England Meteorological Society has been dissolved. It was formed in Boston, in June 1884, to promote the study of atmospheric phenomena in the New England States, and to establish systematic observation. It has done much useful work, especially relating to rainfall, thunderstorms and range of temperature, the results of which have from time to time been published in the above-named journal. The system of regular meteorological observations and the publication of a monthly bulletin were transferred to the New England Weather Service, in connection with the Washington Weather Bureau, several years ago.

The Rebman Publishing Company have issued the first number of the *Archives of Clinical Skiagraphy*, by Mr. Sydney Rowland, being the commencement of a series of collotype illustrations, with descriptive text, illustrating applications of the new photography to medicine and surgery. In an introduction Mr. Rowland gives a brief account of Röntgen's discovery, and describes the great advantages obtained by the use of the form of Crookes' tube known as the focus tube, devised by Mr. Herbert Jackson. The excellent results obtained by British investigators working with X-rays are almost entirely due to the introduction of this form of tube. As to the constitution of fluorescent screens, Mr. Rowland agrees with the conclusion arrived at by Mr. Jackson after a systematic examination of numerous substances, viz. that the best salt to use is platinocyanide of potassium. The plates included in the present number of the *Archives* show the skeleton of a full-grown child, aged three months (exposure fourteen minutes), a needle embedded in a finger (exposure two minutes), knee-joint, from a case of multiple exostosis (exposure nine minutes), and hand of same case (exposure three minutes), wrist and forearm showing syphilitic disease of radius (exposure six minutes). The illustrations may be taken as an indication of how the Röntgen photography is able to supplement diagnosis in all cases of bony disease. It is really astonishing to think that, though Prof. Röntgen's discovery is but a few months old, it has already taken its place among the approved and accepted aids to diagnosis, and a publication has been started to deal with its developments in medicine and surgery.

The additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus*, ♂) from India, presented by Mr. E. Turnham; a Fennec Fox (*Canis cerdo*) from Egypt, presented by Mr. J. G. Mackie; a Mexican Skunk (*Mephitis macrura*) from Mexico, presented by Mr. Henry Heath Cochrane; a Brahminy Kite (*Haliastur indus*) from India, presented by Mr. A. Kemmis-Betty; an African Tantalus (*Tantalus ibis*), a Leopard Tortoise (*Testudo pardalis*) from East Africa, presented by Captain Dugmore; a Canary Finch (*Serinus canarius*) from Madeira, presented by Mr. H. B. Hewetson; a Great Wallaroo (*Macropus robustus*, ♀), a Gould's Monitor (*Varanus gouldi*), a Black and Yellow Cyclodus (*Cyclodus nigroluteus*) from Australia, a Yellow-headed Conure (*Conurus jendaya*), two Brazilian Tortoises (*Testudo tabulata*) from Brazil, five Meyer's Parrots (*Pœocophalus meyeri*), two Alario Sparrows (*Passer alario*) from South Africa, a Brown-throated Conure (*Conurus æruginosus*) from South America, deposited; a Chimpanzee (*Anthropopithecus troglodytes*, ♀) from West Africa, a Red-naped Fruit-Bat (*Pteropus funereus*), —— Bandicoot (*Perameles* ——) from Australia, two Spotted Tinamous (*Nothura maculosa*) from Buenos Ayres, purchased.

OUR ASTRONOMICAL COLUMN.

The Planet Mercury.—An unusually good opportunity of observing the planet Mercury with the naked eye, or with an opera-glass, will be afforded about the middle of the present month. The planet will be at its greatest eastern elongation on May 16, when it will be 22° from the sun, and will remain above the horizon for two hours and a quarter after sunset. At this time the apparent diameter of the planet will be 8″, and about 0·4 of the disc will be illuminated. On May 14, at 6 p.m., the planet will be in conjunction with the moon, Mercury being 2° 24′ to the south; at 9 p.m. on the same evening, the crescent of the two days' moon will be about 3° N.N.E. of the planet.

Comet Swift 1896.—The following continued ephemeris for the new comet is from revised elements computed by Dr. Schorr for Berlin midnight:—

	R.A.	Decl.	Brightness.
	h. m. s.	° ′	
May 8	2 12 41	+62 58·1	
10	1 58 52	64 46·1	0·35
12	1 44 41	66 17·4	
14	1 30 19	+67 33·9	0·26

The unit of brightness is that on April 16. The comet was easily visible in a three-inch telescope on April 30, when the computed brightness was 0·7.

New Divisions of Saturn's Rings.—In the current number of the *Comptes rendus*, M. Flammarion gives particulars of some very interesting observations of Saturn's rings which have been made at his observatory by M. Antoniadi during the last month. Between the Cassini division and the Crape ring, three new divisions of the ring have been noted. The darkest of these, which is easily visible when the air is transparent, nearly bisects the inner bright ring; the fainter divisions, one on each side, are only observed with difficulty. The inner bright ring is thus divided into four zones, gradually darkening towards the planet.

This is by no means the first time that divisions of this kind have been recognised. Herschel, De Vico, Bond, Hall, and others, have in turn observed or suspected them, but Cassini's division is the only one which seems to be certainly permanent. M. Flammarion concludes that the fainter divisions observed on the rings are variable, and possibly dependent upon the varying attractions of the eight satellites upon the meteoritic particles of which the rings are composed.

Determination of the General Brightness of the Corona.—In the current number (vol. vi. No. 6) of the *Journal* of the British Astronomical Association, Mr. Joseph Lunt suggests a method by which a numerical value could be obtained for the general photographic intensity of the light of the corona during a total solar eclipse.

The method consists in photographing a "sensitometer window," consisting of twenty-five numbered squares of graduated opacities (like a Warnerke's sensitometer, but with different values). The opacities are so adjusted that an exposure of ninety seconds to full moon-light, which approximates to the coronal light, should yield a negative showing the figure 12. The negative could be obtained either by direct contact with the "sensitometer window" (as in lantern-slide making), or by forming an image of the "window" on the plate by means of a lens. The plates could be standardised by exposure to any standard artificial light or to full moon-light, according to Mr. Maunders' suggestion, in order to reproduce the precise illumination of the sensitometer window given by the corona. The conditions of development of the negatives for comparison should be identical, and the plates used should all be of identical sensitiveness.

The apparatus required is very simple, consisting of a box of square section, about three feet long, closed at one end by a ½-plate dark slide, and at the other by the ½-plate sensitometer,